AP Statistics Practice Test (page 666)

T10.1 e. Because the values are on a scale of 1 to 20, the populations can't be Normal. However, the large sample sizes justify the use of the two-sample *t* test. Also, the data come from independent random samples that are both less than 10% of their respective populations.

T10.2 b. Because it is a 95% confidence interval, $z^* = 1.96$. Also, we do not use the pooled proportion in the calculation of the standard error for a confidence interval.

T10.3 a. The variable being measured is categorical (removed or not removed), so the population distribution cannot be Normal.

T10.4 a. With smaller degrees of freedom, the t^* will be larger and so the confidence interval will be wider.

T10.5 e. A test for the difference between two means with population standard deviations unknown is a *t* test.

T10.6 e. With the *P*-value less than 0.05 we reject H_0 and have convincing evidence for the alternative hypothesis.

T10.7 c. The confidence interval gives a set of plausible values. Because 0 is given as a plausible value, we cannot rule it out, but we do not know that it is the true difference.

T10.8 c. The standard deviation is $\sqrt{\frac{0.8(0.2)}{100}+\frac{0.5(0.5)}{400}} = 0.047$.

T10.9 b. We are measuring heart attack rate in the two groups, so the method should be to compare two proportions. Because we are asking how big the difference is, the method used should be a confidence interval.

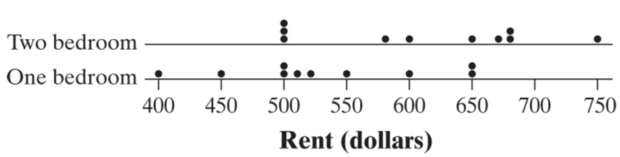
T10.10 a. If we are trying to detect a smaller difference, the power will be smaller because it will be harder to detect the difference.

T10.11 (a) *State:* Our parameters of interest are μ_1 = the true mean hospital stay for patients like these who get heating blankets during surgery and μ_2 = the true mean hospital stay for patients like these who have core temperatures reduced during surgery. We want to estimate the difference $\mu_1 - \mu_2$ at a 95% confidence level. *Plan:* We should use a two-sample *t* interval for $\mu_1 - \mu_2$ if the conditions are met. Random: The data come from two groups in a randomized experiment. Normal/Large Sample: $n_1 = 104 \ge 30$ and $n_2 = 96 \ge 30$. *Do:* The conservative degrees of freedom is 96 – 1 = 95. Using Table B and df = 80, the 95% confidence interval is $(12.1-14.7)\pm 1.990\sqrt{\frac{(4.4)^2}{104}+\frac{(6.5)^2}{96}} = -2.6 \pm 1.57 = (-4.17,-1.03)$. *Using technology*: (–4.16, –1.04) with df = 165.12. *Conclude:* We are 95% confident that the interval from –4.16 to –1.04 captures the true difference in mean length of hospital stay for patients like these who get heating blankets during surgery and those who have their core temperatures reduced during surgery.

(b) Yes. Because 0 is not in the interval, we have convincing evidence that the true mean hospital stay for patients like these who get heating blankets during surgery is different than the true mean hospital stay for patients like these who have core temperatures reduced during surgery.
(c) If we were to repeat this experiment many times and calculate 95% confidence intervals for the difference in mean length of hospital stay each time, about 95% of the intervals would capture the true difference in mean hospital stay for patients like these who get heating blankets during surgery and mean hospital stay for patients like these who have core temperatures reduced during surgery.

T10.12 (a) *State:* We want to perform a test at the $\alpha = 0.05$ significance level of $H_0: p_1 - p_2 = 0$ versus $H_a: p_1 - p_2 > 0$ where p_1 is the true proportion of cars that have the brake defect in last year's model and p_2 is the true proportion of cars that have the brake defect in this year's model. *Plan:* We should use a two-sample *z* test for $p_1 - p_2$ if the conditions are met. Random: The data come from independent random samples. 10%: n_1 = 100 is less than 10% of last year's model and n_2 = 350 is less than 10% of this year's model. Large Counts: The number of successes and failures in both groups are at least 10 (Last year: 20 successes, 80 failures. This year: 50 successes, 300 failures). *Do:* The proportions of defects in each group are $\hat{p}_1 = \frac{20}{100} = 0.2$ and $\hat{p}_2 = \frac{50}{350} = 0.143$. The pooled proportion is $\hat{p}_C = \frac{20+50}{100+350} = \frac{70}{450} = 0.156$. The test statistic is $z = \frac{(0.2 - 0.143) - 0}{\sqrt{\frac{(0.156)(0.844)}{100} + \frac{(0.156)(0.844)}{350}}} = 1.39$ and the *P*-value is 0.0823. Using technology: *z* = 1.39 and *P*-value = 0.0822. Conclude*:* Because the *P*-value of 0.0823 is greater than α = 0.05, we fail to reject H_0. We do not have convincing evidence that the true proportion of brake defects is smaller in this year's model compared to last year's model. (b) A Type I error is finding convincing evidence that there is a smaller proportion of brake defects in this year's car model, when in reality there is not. This might result in more accidents because people think that their brakes are safe. A Type II error is not finding convincing evidence that there is a smaller proportion of brake defects in this year's model, when in reality there is a smaller proportion. This might result in reduced sales of this year's model.

T10.13 (a) H_0: $\mu_1 - \mu_2 = 0$ versus H_a: $\mu_1 - \mu_2 < 0$ where μ_1 = the true mean rent for one-bedroom apartments in the area of her college campus and μ_2 = the true mean rent for two-bedroom apartments in the area of her college campus.
(b) This is a two-sample *t* test for $\mu_1 - \mu_2$. Random: The data come from independent random samples. 10%: n_1 = 10 is less than 10% of all one-bedroom apartments in this area and n_2 = 10 is less than 10% of all two-bedroom apartments in this area. Normal/Large Sample: Because there are fewer than 30 observations in each sample we need to graph the data. The dotplots below show no strong skewness or outliers in either distribution, so it is reasonable to use a two-sample *t* procedure.



(c) Assuming the true mean rent of the two types of apartments is really the same, there is a 0.029 probability of getting an observed difference in mean rents as large as or larger than the one in this study.

(d) Because the *P*-value of 0.029 is less than α = 0.05, Pat should reject H_0. She has convincing evidence that the true mean rent of two-bedroom apartments is greater than the true mean rent of one-bedroom apartments in the area of her college campus.